

*These are A/F Lenses
on our design
Through Wright Patterson*

P. R. NR. 120274RNR

Date: 1 March 1961

TABLE I

OPTICAL CHARACTERISTICS REQUIREMENTS

<u>REQUIREMENT</u>	<u>2X LENS</u>	<u>4X LENS</u>
Equivalent focal length	No greater than 16 inches	No greater than 10 inches
Field of View	5 x 5 inch square area at 2:1 magnification	2-1/2 x 2-1/2 inch square area at 4:1 magnification
Relative Aperture	f/4 or faster	f/4 or faster
Transmittance	70 percent (minimum)	70 percent (minimum)
Relative Illumination	78 percent (minimum) of axial illumination anywhere in format	78 percent (minimum) of axial illumination anywhere in format
Distortion	0.10 millimeter (maximum) anywhere in the format of the projected image at 2:1	0.10 millimeter (maximum) anywhere in the format of the projected image at 4:1
Color Correction	Corrected for a wave length between 3500A to 4500A	Corrected for a wave length between 3500A to 4500A
Lens Mounting	Lens shall be barrel mounted having threads in accordance with ASA Standards	Lens shall be barrel mounted having threads in accordance with ASA Standards
Iris Diaphragm	Iris diaphragm calibrated in f-stops for maximum aperture of at least f/16	Iris diaphragm calibrated in f-stops for maximum aperture of at least f/16
Lens Caps	Lens shall be fitted with two caps	Lens shall be fitted with two caps

B. Resolving Power - Each lens shall be capable of resolving a minimum of 200 lines per millimeter radially and tangentially anywhere in their respective negative formats when tested by the Projected Photograph Resolving Power Method MIL-STD-150A. This shall give an effective resolution at the image plane of not less than 50 and 100 lens per millimeter at the respective magnifications of 4x and 2x enlargement. Resolution readings shall be resolved from low contrast (0.20 ± 0.05 log contrast) targets in accordance with MIL-STD-150A.

EXHIBIT A

3-1/4 x 2-1/4 and 4-1/2 x 4-1/2 INCH FORMATS

This procurement will provide for applied research and experimentation for the purpose of obtaining the design of precision enlarging lenses for use with 2-1/4 x 2-1/4 inch and 4-1/2 x 4-1/2 inch negative formats. The lenses fabricated on this research program will be experimental models to be used for evaluating the optical formula obtained from the design study program. It is intended that these experimental lenses shall be capable of enlarging and retaining information detail from extremely high resolution aerial materials.

The objective of this procurement is to provide the USAF with an applied research program which will provide a series of highly corrected precision enlarging lenses, producing maximum image quality at their respective enlargement ratios. Two projection lens designs will be obtained from this research effort having the enlargement ratios of two and four diameters magnification. The two diameter lens shall be designed for use with 4-1/2 x 4-1/2 inch format photography, and the four diameter lens for use with 2-1/4 x 2-1/4 inch format photography.

A. The specific design requirements of the two lens systems shall conform to the optical characteristics and dimensions as itemized in Table I below. The requirements for the optical characteristics and resolving power apply only to the 4-1/2 x 4-1/2 and 2-1/4 x 2-1/4 formats, the additional coverage being intended for the recording of the numerical data adjacent to the picture area.

P.O. No. 121974RNR

DATE: 1 March 1961

C. Color Correction Filter - Each lens shall be corrected for a wave length between 3500Å to 4500Å. The exact wave length shall be determined by an applicable interference filter with a peak transmittance within this range. The filter shall have a band width of approximately 80Å. Each lens shall be furnished with a color correction filter.

IV. FUNCTIONAL EVALUATION AND TESTING

A. Responsibility for Tests - The contractor shall be required to perform sufficient functional tests and furnish test data to insure the design meets all the requirements as specified in this statement of work.

STATINTL B. Materials for Test - The film material to be used for all evaluation tests shall be experimental SO-278 or equal. This material is equivalent to a high resolution fine grain duplicating, and print material.

C. Developing - The film material used for all tests shall be developed in Armed Forces Developer #2 conforming to Specification MIL-D-4875. Development time shall be 5 minutes with the developer at 68°F. Equivalent times shall be used if the developer solutions are used at different temperatures.

D. Resolution Test Negatives - Two resolution test negatives shall be used for the resolution test and shall contain low contrast (0.20 ± 0.05 log contrast) targets. One test negative shall have target patterns positioned in a 2-1/4 inch x 2-1/4 inch format area and, the other test negative shall have target patterns positioned in a 4-1/2 inch x 4-1/2 inch format area. All targets shall be positioned in each format area as shown in MIL-STD-150A. The target patterns shall cover a range of resolution from 20 to 225 lines/mm. The test patterns shall be made up of light lines on a dark background.

E. Resolving Power Tests - A photographic test, in conformance with Method 14 of MIL-STD-150A, shall be made on each lens. The resolution test targets shall be used as negatives and printed onto the specified printing material using the specified developer.

F. Relative Illumination - Relative illumination shall be measured by Method 7 or Method 8 of MIL-STD-150A. Measurements shall be made using the color correction filter.

G. Transmittance - The transmittance shall be measured by Method 5 or Method 6 of MIL-STD-150A. Measurements shall be made using the color correction filter.

H. Relative Aperture - The relative aperture shall be computed by the ratio of the equivalent focal length to the diameter of the effective aperture. The effective aperture shall be measured by Method 3 or Method 4 of MIL-STD-150A.

I. Distortion - Distortion shall be measured by Method 30 of MIL-STD-150A.